ISL73006SLHEV1Z

The ISL73006SLHEV1Z evaluation board (Figure 3) features the ISL73006SLH buck regulator. This IC is a small foot print radiation hardened POL designed for critical low power applications.

The ISL73006SLH is operational over 3V to 18V integrating both high-side and low-side power FETs and switches at a native 500kHz frequency. The ISL73006SLH uses constant-frequency peak current mode control architecture for fast loop transient response. The ISL73006SLH can use either its internal compensation or an external Type II compensation to stabilize the loop as determined by specific design and performance requirements.

By integrating both P-channel and N-channel power devices and with the option of internal compensation, a minimum of external components are required, thereby reducing the BOM count and complexity of the design.

The ISL73006SLHEV1Z evaluation board and this accompanying manual provide a quick and easy method to evaluate the ISL73006SLH part in both an internal or an external compensation configuration.

See the *ISL73006SLH datasheet* for information about the operation, function, and performance of the device.

Features

- Optimized for 12V to 3.3V conversion
- Jumper configurable to either the internal or external slope and compensation configuration
- 1A output current
- On board transient generator

Specifications

The ISL73006SLHEV1Z evaluation board is configurable by jumpers for either external or internal configuration of compensation or slope.

The board allows for other conditions to be evaluated with user-modification of components and connections.

The electrical ratings of the ISL73006SLHEV1Z evaluation board are shown in Table 1.

Table 1. Electrical Ratings

Parameter	Rating
PVIN Supply Voltage	6V - 18V
DC Output Voltage	3.3V
Operating Frequency	500kHz
Output Current	1A
Temperature	-55ºC to +125ºC

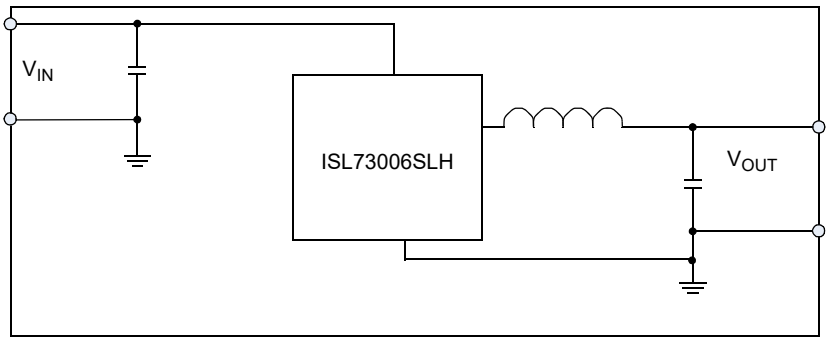

Figure 1. Block Diagram

Contents

1. Functional Description

The ISL73006SLHEV1Z evaluation board is configured by default for 12V to 3.3V conversion with a 1A maximum output current and contains the ISL73006SLH voltage regulator IC. Any external configurations for control loop and slope compensations can be chosen by jumpers JP5 and JP3, respectively. Figure 1 shows the ISL73006SLHEV1Z evaluation board block diagram. Figure 3 shows the ISL73006SLHEV1Z board image.

The ISL73006SLHEV1Z evaluation board provides test point access to critical pins of the IC device and convenient pads for connecting test equipment. For more information, see the schematic (Figure 5), PCB layers (Figure 7 through Figure 12), and Bill of Materials. Figure 13 through Figure 22 show the performance data using the ISL73006SLHEV1Z and basic lab equipment.

1.1 Operational Characteristics

The ISL73006SLHEV1Z only requires a single voltage supply > 6V connected to the PVIN pad to operate, outputting 3.3V on the VOUT pad with a 1A output current capability. Configured for a nominal PVIN voltage of 12V, the input operating voltage at which the IC turns on is set by the resistor divider (R_1 and R_2) on the ENABLE pin.

Note: Do not exceed 5V on the ENABLE pin.

1.2 Setup and Configuration

The following equipment is recommended for testing the board:

- 12V power supply
- 100MHz oscilloscope

Complete the following steps to configure and use the board:

1. Configure the board as shown in Figure 2.
2. Connect and turn on a 12V power supply to the PVIN pad.
3. Use the oscilloscope to look at VIN and VOUT waveforms and observe the behavior of the LX phase node located on pin 10 of the IC package. Proper probe grounding must be practiced when observing clean waveforms.
4. Output current loading can be externally added at the VOUT and GND pads for loaded output evaluations. A DVM(s) can monitor the input and output voltages and currents.

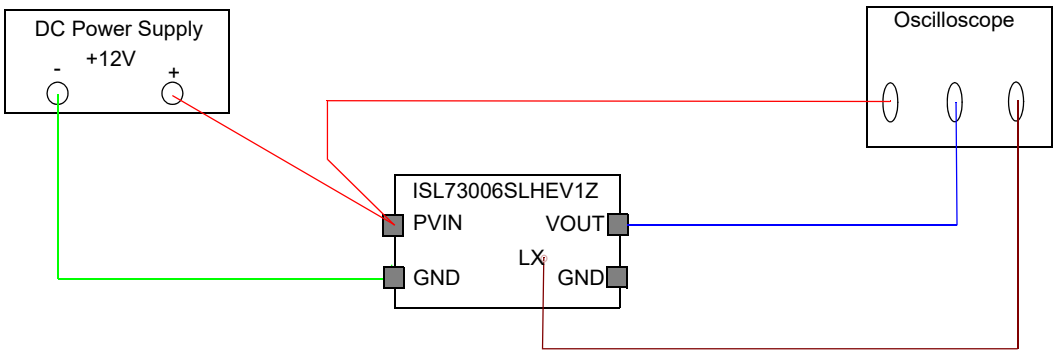

Figure 2. ISL73006SLH Basic Evaluation Test Setup Block Diagram

2. Board Design

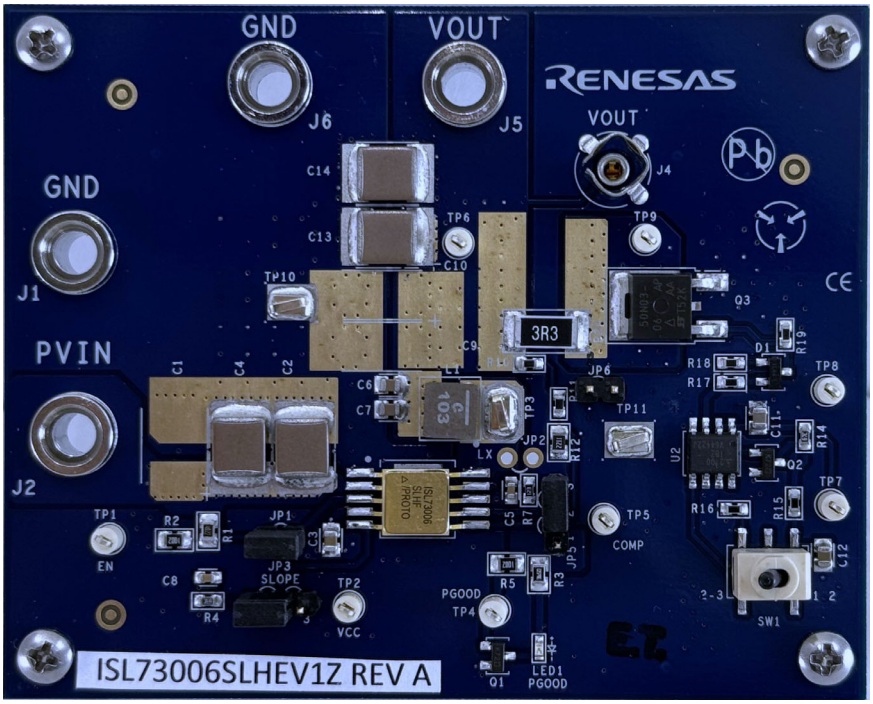

Figure 3. Evaluation Board (Top)

Figure 4. Evaluation Board (Bottom)

2.1 Basic Layout

The ISL73006SLH is located in the lower center of the board and is labeled U1. Connect the input power across the PVIN and GND jacks. The output voltage appears across the VOUT and GND jacks. C_{IN} is provided by C_2 and C_4. The output LC filter is comprised of the L_{OUT}, L_1, and C_{OUT} is provided by C_{13} and C_{14}. JP1 sets the EN threshold to enable the IC when PVIN is ~6V; otherwise, ENABLE can be accessed by TP1. The transient generator circuit is towards the right of the board. Consult the schematic in (Figure 5) for details.

2.2 Layout Guidelines

PCB design is critical to reducing parasitic inductances, with critical components being closely placed next to the IC. The critical components are the loop compensation RC, the slope resistor, and the low ESR ceramic input capacitors. Avoid placing traces or components under the LX shapes to avoid noise coupling from the switching node.

2.3 Schematic Diagrams

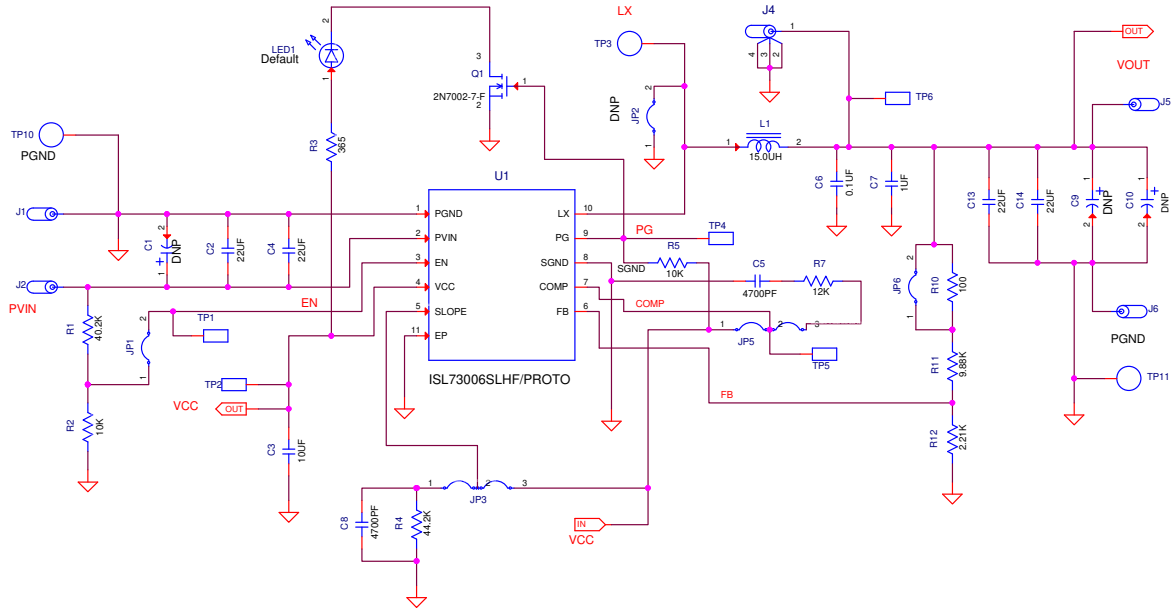

Figure 5. ISL73006SLHEV1ZSchematic

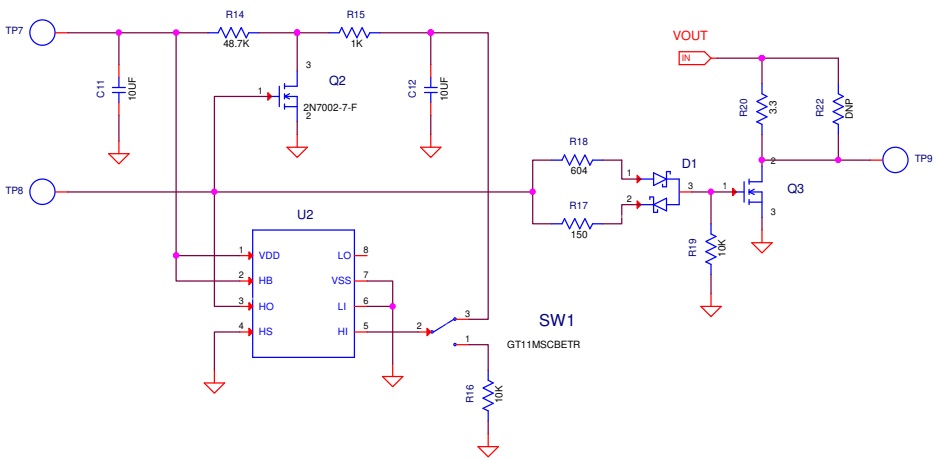

Figure 6. Transient Generator Schematic

2.4 Bill of Materials

Reference Designator	Description	Manufacturer	Manufacturer Part
U1	IC-RAD HARD 1A POL REGULATOR	Renesas Electronics	ISL73006SLHF/PROTO
L1	COIL-PWR INDUCT, SMD, 5.4×5.2mm, 15µH.20%, 3.7A, 76.6mohm, ROHS	Coilcraft	XEL5050-153MEC
C2, C4, C13, C14	22µF, Multilayer Cap	Various	Generic
C3	10µF, Multilayer Cap	Various	Generic
C5	4700pF, Multilayer Cap	Various	Generic
C6	0.1µF, Multilayer Cap	Various	Generic
C7	1µF, Multilayer Cap	Various	Generic
C8	0.001µF, Multilayer Cap	Various	Generic
R1	40.1kΩ, Thick Film Chip Resistor	Various	Generic
R2, R5	10kΩ, Thick Film Chip Resistor	Various	Generic
R3	365Ω, Thick Film Chip Resistor	Various	Generic
R4	44.2kΩ, Thick Film Chip Resistor	Various	Generic
R7	12kΩ, Thick Film Chip Resistor	Various	Generic
R10	100Ω, Thick Film Chip Resistor	Various	Generic
R11	9.88kΩ, Thin Film Chip Resistor	Various	Generic
R12	2.21kΩ, Thick Film Chip Resistor	Various	Generic
JP1	Two Pin Jumper	Generic	JUMPER2_100
JP3, JP5	Three Pin Jumper	Generic	JUMPER-3-100
JP2, JP6	Two Point Differential Test Points	Generic	JUMPER2_100
Q1	N-Channel EMF Effect Transistor (Pb-FREE)	Generic	2N7002-7-F
LED1	AlInGaP Green LED	LITEON	LTST-C190KGKT
Transient Generator Components			
U2	100V/2A Peak High Freq Half Bridge Driver (Pb-FREE)	Renesas	HIP2100IBZ
Q2	N-Channel EMF Effect Transistor (Pb-FREE)	FAIRCHILD	2N7002-7-F
Q3	N-Channel 30V (D-S) MOSFET (RoHS compliant)	VISHAY	SUD50N03-06AP-E3
C11, C12	10µF Ceramic Chip Capacitor	Samsung	CL21B106KOQNNNE
R14	48.7kΩ Thick Film Chip Resistor	Various	Generic
R15	1kΩ Thick Film Chip Resistor	Various	Generic
R16, R19	10kΩ Thick Film Chip Resistor	Various	Generic
R17	150Ω Thick Film Chip Resistor	Various	Generic

Reference Designator	Description	Manufacturer	Manufacturer Part
R18	604Ω Thick Film Chip Resistor	Various	Generic
R20-R22	3.3Ω Thick Film Chip Resistor	Various	Generic
D1	30V 200mA SCHOTTKY BARRIER DIODE	DIODES	BAT54S
SW1	SPDT On-None-On (2 Switch Positions) SM Ultraminiature Toggle Switch	C&K	GT11MSCBETR

2.5 Board Layout

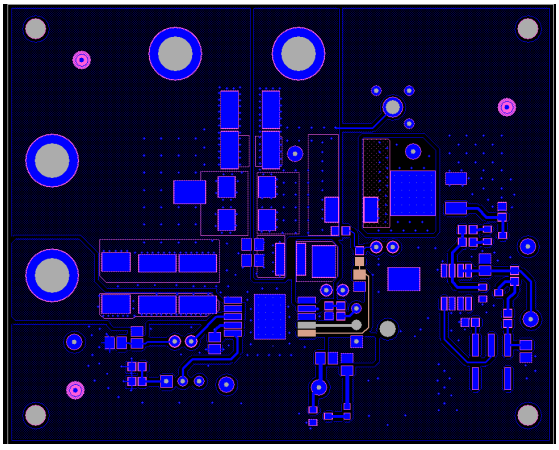

Figure 7. Top Layer

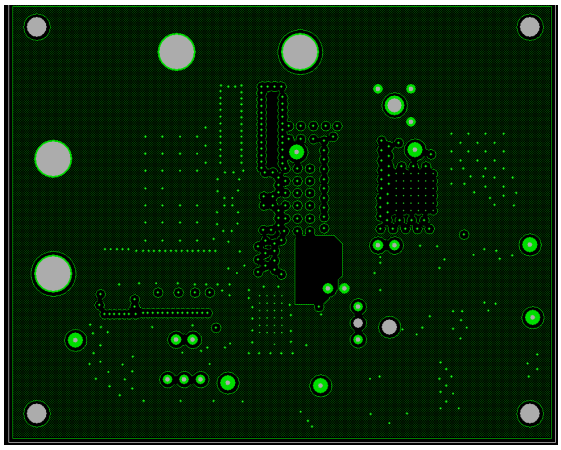

Figure 8. Layer 2

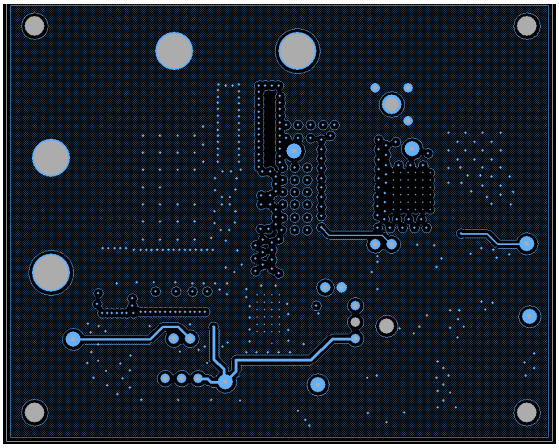

Figure 9. Layer 3

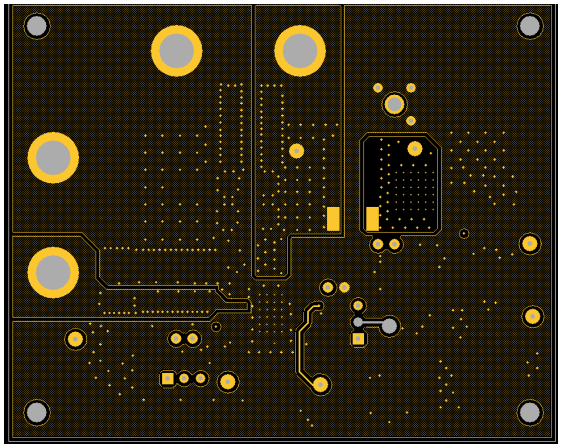

Figure 10. Bottom Layer

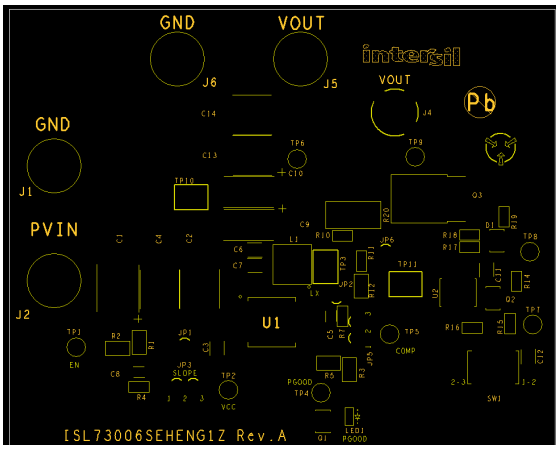

Figure 11. Top Silk Layer

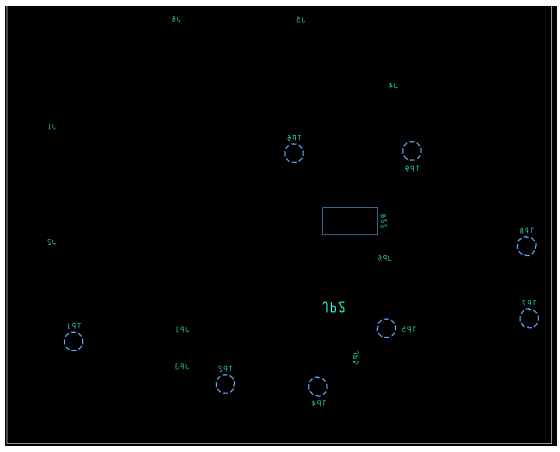

Figure 12. Bottom Silk Layer

3. Typical Performance Graphs

Unless otherwise noted, PVIN = 12V; V_{OUT} = 3.3V, f_{SW} = 500kHz, T_A = Room Ambient

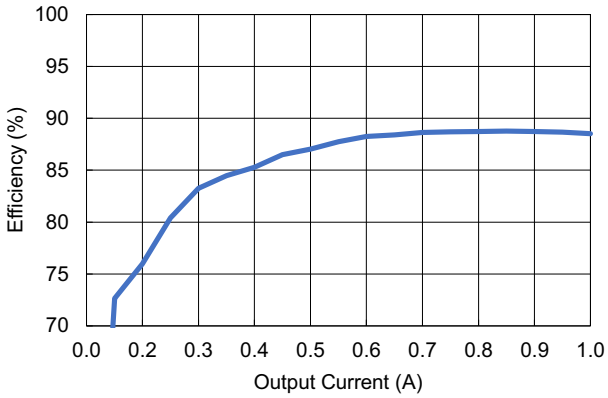

Figure 13. Efficiency

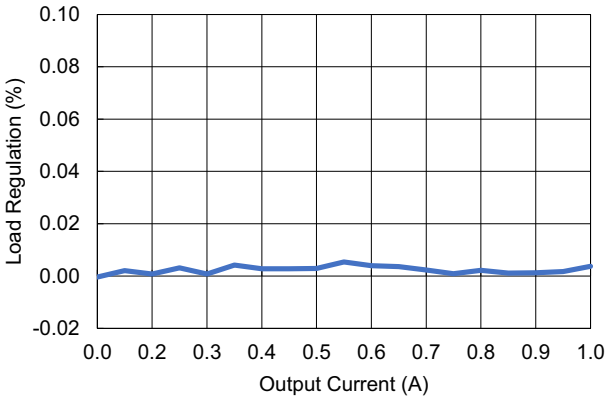

Figure 14. Load Regulation Internal and External Comp

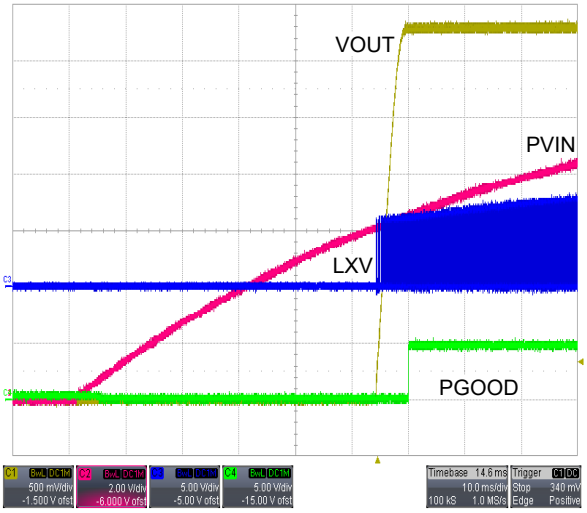

Figure 15. Turn-On by PVIN, 3Ω Load

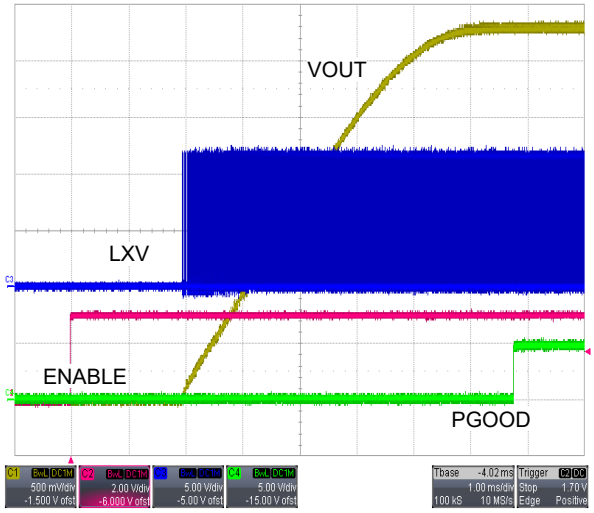

Figure 16. Enabled Turn-On, 3Ω Load

Unless otherwise noted, PVIN = 12V; V_{OUT} = 3.3V, f_{SW} = 500kHz, T_A = Room Ambient (Cont.)

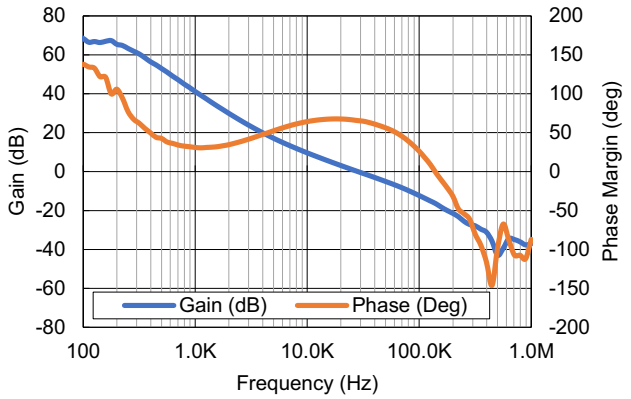

Figure 17. Ext Comp Gain/Phase Bode Plot, I_{OUT} = 0.5A

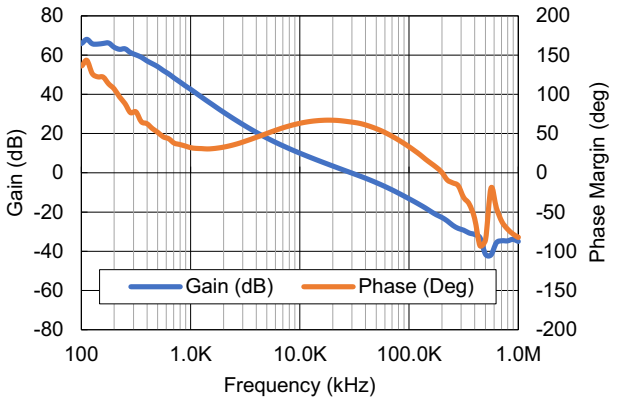

Figure 18. Int Comp Gain/Phase Bode Plot, I_{OUT} = 0.5A

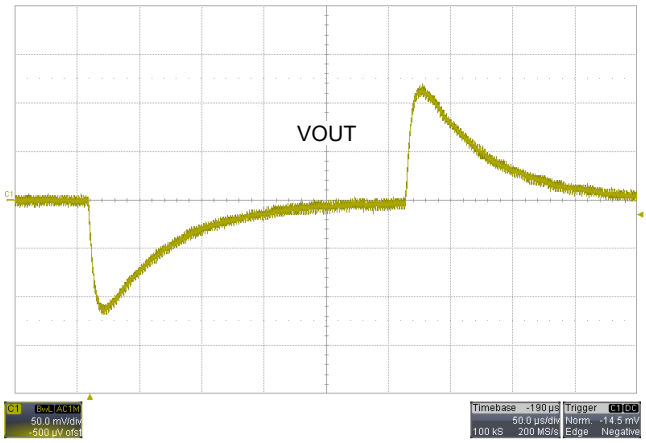

Figure 19. 1A Load Transient (External Compensation)

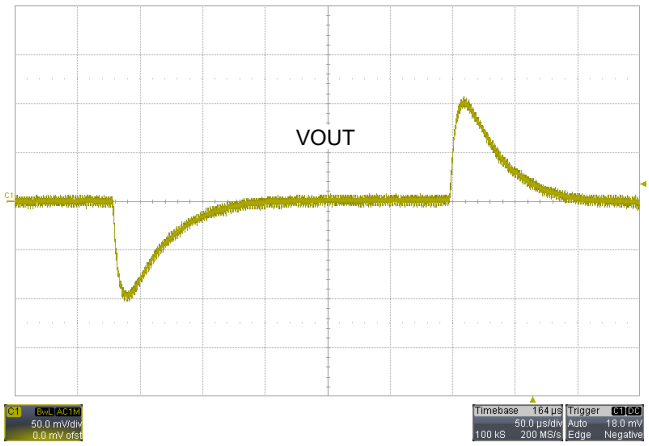

Figure 20. 1A Load Transient (Internal Compensation)

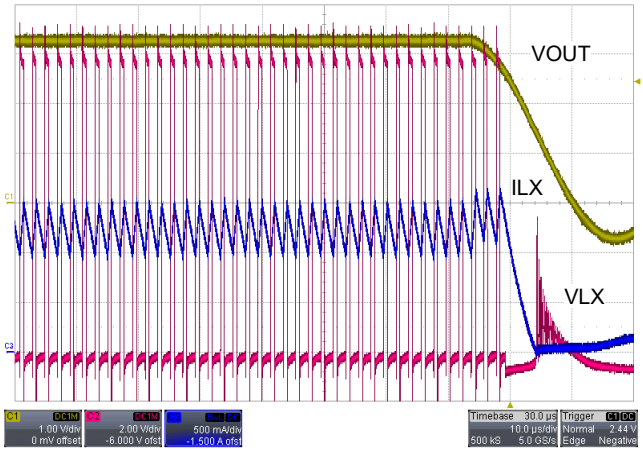

Figure 21. Positive Overcurrent Protection

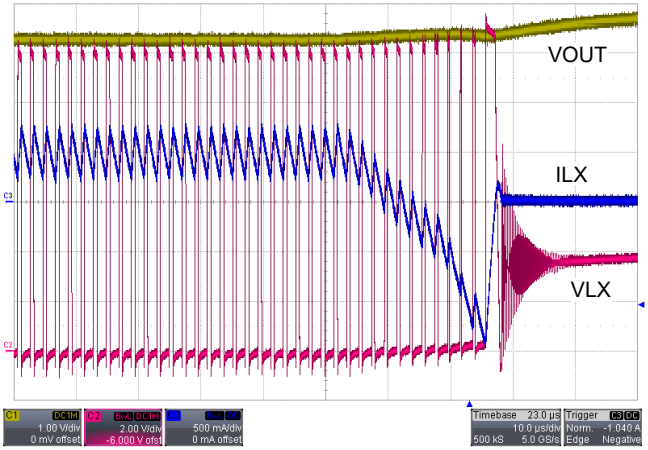

Figure 22. Negative Overcurrent Protection

4. Ordering Information

Part Number	Description
ISL73006SLHEV1Z	Radiation Hardened ISL73006SLH buck regulator Evaluation board for $12V_{IN}$ to $3.3V_{OUT}$, includes feature configuration jumpers for loop and slope compensation, test points, and transient load generator

5. Revision History

Revision	Date	Description
1.00	Jan 16, 2024	Initial release

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